FLOOD HAZARD STUDY

CITY OF KENAI

KENAI PENINSULA BOROUGH

ALASKA

Prepared By

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
2221 E. Northern Lights, Suite 129
Anchorage, Alaska 99504

In Cooperation With

City of Kenai

June 1981

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INTRODUCTION

The City of Kenai and the Kenai Kasilof Soil Conservation Subdistrict requested the Soil Conservation Service to carry out flood hazard studies of streams within the City of Kenai. Kenai is a rapidly growing city with oil and gas production, processing, other manufacturing and services increasing within the City and on the Kenai Peninsula. The people associated with this development need to know the areas subject to flooding and the nature of the flooding in order to ensure development free of potential flood damages. This report defines the areas subject to flooding and some flood plain management programs that can be implemented to regulate land use and development in flood hazard areas.

The study was authorized in accordance with the October 1978 Joint Coordination Agreement between the Alaska Department of Natural Resources, the Alaska Soil Conservation District and the Soil Conservation Service. The October 1979 Plan of Study outlines the specific details of this investigation.

Authority for SCS participation in flood hazard studies is set forth in Section 6 of Public Law 83-566 (Watershed Protection and Flood Prevention Act of 1954). The SCS carries out such studies in accordance with Executive Order 11988 dated May 4, 1977, and Recommendation 9(c) of House Document No. 465, 89th Congress.

The state has flood plain regulation authority under Administrative Order 46. The Kenai Peninsula Borough has authority for regulation of flood plains under the National Flood Insurance Program. The City of Kenai has authority to regulate subdivision, zoning, water and sewer lines and drainage development.

DESCRIPTION OF THE STUDY AREA

Kenai is located 78 miles north of Homer and 150 miles south of Anchorage adjacent to the Kenai River and Cook Inlet. The city is situated on a bench approximately 80 feet in elevation at the mouth of the Kenai River. This bench is a mild sloping outwash plain of an ancient glacier and consists of sand and fine gravel with thin layers of fine sand and silt. The surface soils is a silt loam rich in organic matter. Approximately 20 square miles of the outwash plain drains through Kenai in five small unnamed creeks. Each creek is much wider and deeper than would be expected with the present climate and vegetation. These valleys were formed when vegetation was sparse and glacier runoff was large. Beaver Creek also drains part of this outwash plain plus a substantial area of choppy, sloping terrain with hills, lakes and marshes created by the glacier's terminal moraine.

Vegetative cover is grass, sedges, willows, alder and other water tolerant brush in wet areas and mixed spruce and birch on well drained sites. Many of these cover types can be identified on the photo maps.

For the purpose of this study the unnamed creeks are distinguished by letters of the alphabet beginning with the one nearest Beaver Creek called No Name "A." A field evaluation indicated that Beaver Creek, No Name "A" Creek and No Name "E" Creek required delineation of flood hazards. Delineation of flood hazards was not needed for No Name "B", No Name "C" and No Name "D" Creeks, however, since each is very narrow, has steep sides and drains only a small area.

No Name "A" Creek is a special case in that it does not have a distinct channel to its outlet, the Kenai River. A gentle swale begins at the upstream wetlands and gradually becomes a creek at Kenai Spur Highway. At the edge of the bench approximately one mile below the highway, it spreads out on a mild slope and crosses under Beaver Loop Road through several culverts. Possible local flooding from culvert blockage or channel icing in this area is not considered in this report.

The study area is in Water Resources Council Hydrologic Unit no. 19050002 within a transitional climatic zone influenced by both maritime and continental factors. Mean annual precipitation is 18.4 inches and mean annual temperature is 33.3 degrees F. The average frost free period is from June 1 to September 4. The climate is moderated by the Pacific Ocean so that winters are milder and summers are cooler than interior Alaska. The summer is moist and the spring generally is dry. Average annual snowfall is 64 inches. Snow remains on the ground for several months each year, but the time of melt varies greatly. Some winters have several brief warm periods that melt the snow gradually while others have remained cold until May and then warmed up rather rapidly. Rain storms accompanying this rapid warm up and consequent snowmelt may generate floods. Such events are of long duration and generate peak discharges per square mile that are about the same for small watersheds as for large ones.

Peak discharges used for the water surface profile computations are based on 11 years of discharge measurements on Beaver Creek.

Elevation-discharge relationships were developed for culverts and valley sections of the larger creeks utilizing the water surface profile computer program WSP2 outlined in SCS Technical Release No. 61. Flow in small creeks was analyzed with a desk calculator. There are no existing flood marks to check the accuracy of computed water surface profiles.

The flood elevations computed for the selected storm frequencies in this report are to be considered minimal. During flood flow, debris may obstruct culverts and cause greater water depths than shown in Tables 1, 2, and 3. Ice or aufeis may form in channels and decrease flow capacity. Since the frequency of channel blocking is indeterminate, only the present physical characteristics of the culverts and channels were used in the computations.

Flooded areas indicated on the photo maps total 69 acres for 100 year flood and 70 acres for 500 year flood on No Name "E" Creek; 24 acres for 100 year flood and 52 acres for 500 year flood on No Name "A" Creek; and 138 acres for 100 year flood and 166 acres for 500 year flood on Beaver Creek. Note that tidewater areas are included at the mouths of No Name "E" Creek and Beaver Creek.

Computed flood elevations at cross sections on the three creeks are shown in Tables 1, 2, and 3.

Flood elevations are based on sea level datum. The elevation of any location within the city can be estimated from the topographic maps available in the City Engineer's Office. Elevation can be determined precisely by reference to the U.S. Coast and Geodetic Survey bench marks.

NATURAL AND BENEFICIAL VALUES

The plant community within each flood plain is predominantly natural. Flood plains of steep reaches have dense alder and blue joint grass while those with flatter slopes have mixtures of mosses, grasses, sedges and low shrubs common to muskegs in this area. Black spruce grows along the flood plain edges. The valley sides are densely covered with white spruce and birch. A few small ponds have been created by the road fills across the creeks.

Natural flood plain vegetation is vital to the stability of each creek because without it the soil would erode seriously. The flood plains provide space for flood flows to expand and thereby avoid high velocities, but they are small and reduce flood peaks a small amount.

The flood plains are aesthetically pleasing and are used by local children in their play and by wild animals. Small animals such as muskrat, mink, voles and shrews are permanent residents while moose, foxes, coyotes, ducks and many other birds migrate through the area. Residences have been built near the stream as proximity to a strip of natural terrain and vegetation appears valuable to the home owners.

Aquatic animals use the creeks according to stream characteristics. Beaver Creek has habitat for salmon and trout and is part of the fishery managed by Alaska Department of Fish and Game. The other streams are small and broken into segments by various barriers and are able to support only simpler forms of aquatic life.

FLOOD PROBLEMS

There is no history of flood damage along the creeks because (1) all development has occurred on high ground and (2) a very large flood has not occurred since present roads and other developments were constructed. The light rain and rapid snow melt of May 1972 produced a flood in Beaver Creek which is calculated to have 25 year return frequency.

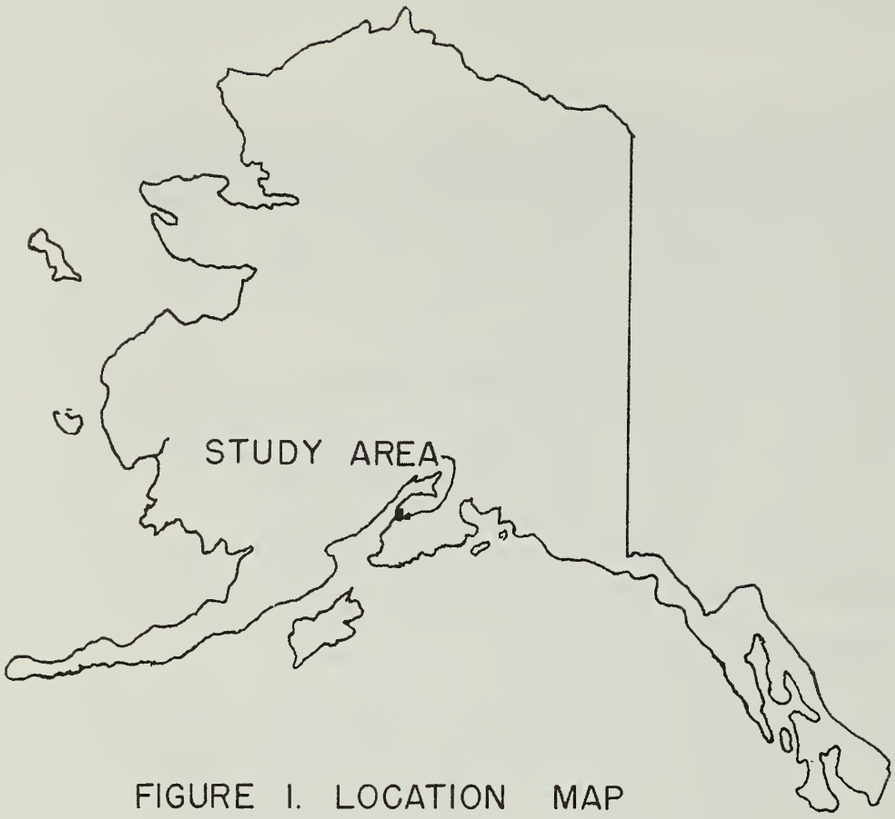


FIGURE I. LOCATION MAP

Photo 1. No-Name "A" Creek at Primrose Street

Photo 2. No Name "E" Creek at Fourth Street

FUTURE FLOOD POTENTIAL

Streamflow characteristics will probably not change significantly unless there is a great change in watershed conditions. Burning of upstream wetlands could temporarily increase flood flows. Drainage and construction in the wetlands could cause a permanent increase in peak flows. Natural variations of precipitation and temperature will continue to cause great variations of streamflow from one season to another.

Filling along the streams for residential development creates a unique potential for flood damage if the fill material should be weakened by saturation and quick drainage as flood waters rise and fall rapidly. A house built well above the flood line upon this fill might later settle or slide if the earth fill is not properly designed and constructed.

The basic data used for determining the flood hazard information in this report is on file in the office of U.S. Department of Agriculture, Soil Conservation Service, 2221 E. Northern Lights Blvd., Suite 129, Anchorage, Alaska 99504.

FLOOD PLAIN MANAGEMENT

Management Programs

Flood plain management is concerned with the future role of the flood plain as an integral part of a community and of a total stream system. Flood hazard information is a prerequisite to sound flood plain management. The objective of this report and data is to define the areas subject to flooding so that adequate management programs can be implemented that will give explicit consideration to the risks for human life and property. Flood hazard problems may be minimized by applications of the following courses of action singly or in combinations: (1) modifying the susceptibility to flood damage and disruption, (2) regulating the floods themselves, and (3) reducing the flood impact on the individual and the community.

Actions used to modify the susceptibility to flood damages and disruptions include flood plain regulations, development and redevelopment policies, disaster preparedness and response plans, flood-proofing, and flood forecasting and warning. Flood plain regulations may be state or local actions. There are no existing city or county regulations for the reduction of flood damages. When adopted, they may include zoning, subdivision regulation, building and housing codes, sanitary codes, etc., with specific flood hazard provisions.

Floods may be regulated by construction of dams, dikes, channel alterations, high flow diversions, land treatment measures, and on-site detention measures. Flood modifications alone encourage a false sense of security which can lead to misuse of lands in areas directly protected and in adjacent areas resulting in increased flood losses.

Reducing the impact of flood losses consists of programs designed to assist the individual and the community in the preparatory, survival, and recovery phases of floods. These include information and education, flood insurance, tax adjustments, flood emergency measures, and a post flood recovery plan. The City and Borough are participating in the emergency phase of the National Flood Insurance Program administered by the Flood Insurance Administration of the U.S. Department of Housing and Urban Development. The program, established by Congress in the National Flood Insurance Act of 1968 and expanded in the Flood Disaster Protection Act of 1973, is designed to provide flood insurance at a standard subsidized rate. In return, communities must adopt and administer local measures that protect lives and new construction from future flooding. Applications for flood insurance policies may be obtained from any insurance agent or broker licensed to sell property or casualty insurance in the community.

FLOOD PLAIN MANAGEMENT OPTIONS

It is not the intent of this report to provide solutions to flood problems in the study area, but to furnish an information base for the adoption of an overall flood plain management program. Other management programs dealing with environmental values of flood plains may also utilize this information. The following are recommendations which should be emphasized during development and implementation of this program.

1. Adopt flood plain regulations in compliance with the National Flood Insurance Program. The regulations should address such things as minimum flood elevations, floodways, greenbelt areas, adequate drainage facilities, building and housing codes, and sanitary codes with specific flood hazard provisions for all new construction.

2. Consider nonstructural measures for flood prevention such as retention of flood plains in public ownership, flood plain acquisition, flood-proofing, and flood forecasting and warning systems. Federal cost sharing for these measures may be available under Section 73(b) of Public Law 93-251. The realization of the need for a flood warning system is due to the projected development of the flood plains and the high velocities in the streams. The National Weather Service of the National Oceanic and Atmospheric Administration issues frequent warnings of potential flood producing storms. Frequently the flood warnings are preceded by a "severe weather or flood watch."

3. Land development and/or subdivision ordinances should require competent design and construction along the streams with emphasis on slope stability especially where water seeps may occur on the slopes. Also the ordinance should include provisions for on-site erosion control and runoff and sediment storage.

4. Owners of property subject to flood damage (including areas adjacent to the delineated flood hazard areas) should be encouraged to purchase flood insurance on their buildings, mobile homes and their contents.

5. Develop a regular maintenance program to keep all culvert and bridge openings, approach channels, and outfall channels clear of sediment and debris. Culvert entrances should be cleared of debris each fall in preparation for next spring's snowmelt.

6. A land treatment program should be implemented for all undeveloped lands in the study area to maintain the present low rates of runoff, erosion and sedimentation.

GLOSSARY

AUFEIS - Ice forming on the bottom of a channel or overflow area rather than on the water surface.

CFS - Abbreviation for cubic feet per second. The rate of discharge or flow of water representing a volume of 1 cubic foot passing a given point during 1 second.

CHANNEL - A natural or artificially created open conduit that periodically or continuously conveys water. River, creek, stream, branch, and tributary are some of the terms used to describe channels.

CROSS SECTION - A section across a valley to show the valley's size and shape at that location. It is measured perpendicular to the principal water flow and is plotted as viewed downstream.

DRAINAGE AREA - The area, measured in a horizontal plane, which drains into a stream at a specified location. See watershed.

FLOOD - An overflow or inundation of normal dry lands from a stream or other body of water; the high streamflow overtopping the banks of a stream; or a high flow as measured by either stage or discharge.

FLOOD HAZARD AREA PHOTOMAP - A photographic map which indicates areas likely to be flooded by the 100-year frequency or the one percent chance flood and the 500-year or 0.2% chance flood.

WATERSHED - The area contributing direct runoff to a stream. Usually it is assumed that base flow in the stream also comes from the same area. However, the ground water watershed may be larger or smaller.

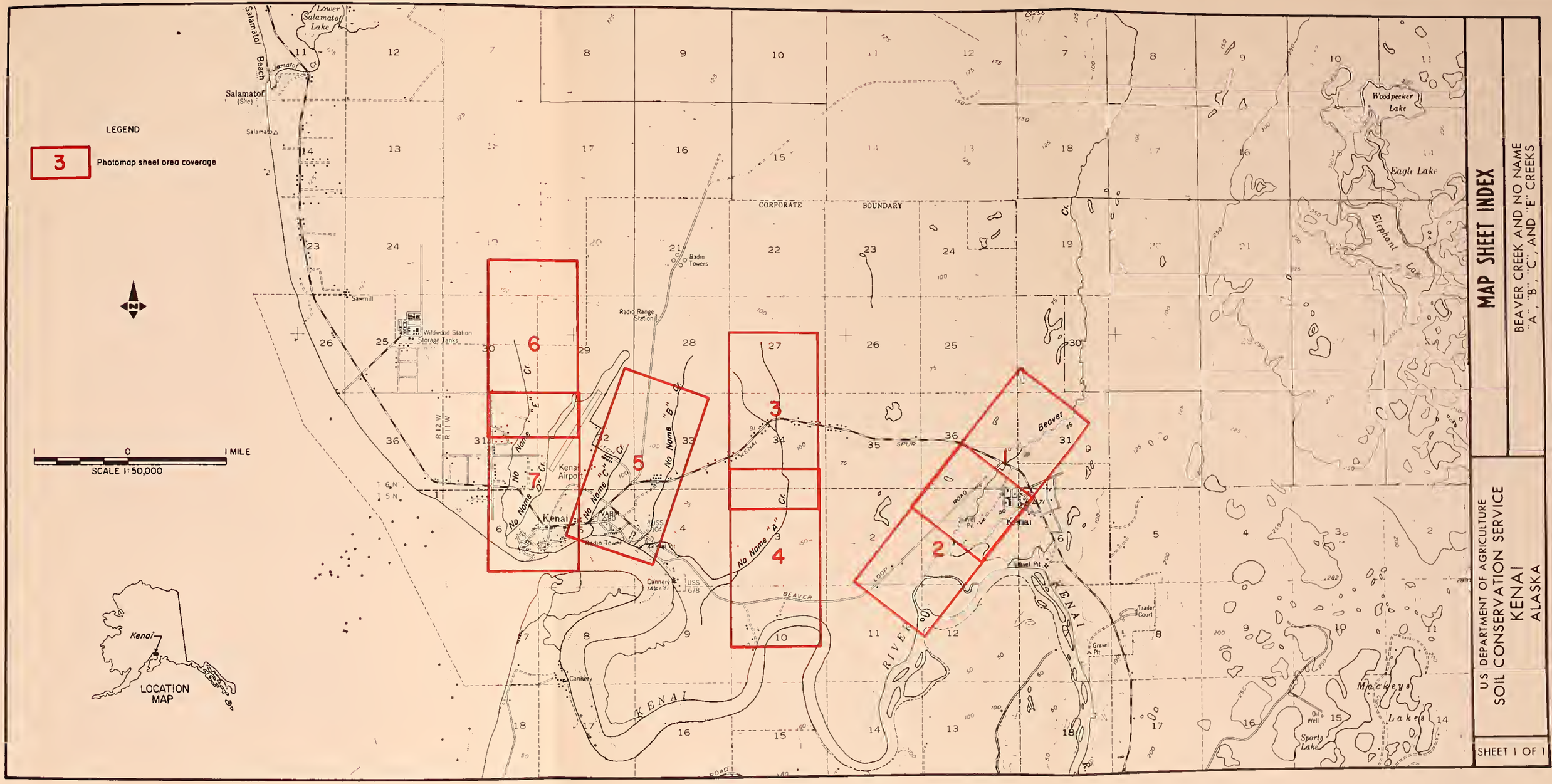
REFERENCES

United States Soil Conservation Service Technical Release No. 61 "WSP2 Computer Program."

United States Geological Survey Water Resources Investigation 78-129 "Flood Characteristics of Alaskan Streams."

United States Soil Conservation Service National Engineering Handbook Section 4 "Hydrology."

United States Water Resources Council Bulletin #17A "Guidelines for Developing Flood Flow Frequency."


LEGEND
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Photomap sheet area coverage
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LOCATION MAP
Kenai
MAP SHEET INDEX
BEAVER CREEK AND NO NAME "A", "B", "C", AND "E" CREEKS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENAI
ALASKA
SHEET 1 OF 1
CORPORATE BOUNDARY
Salamatof Beach
Salamatof (Site)
Lower Salamatof Lake
Woodpecker Lake
Eagle Lake
Elephant Lake
Mackeys Lakes
Sporty Lake
Sawmill
Radio Towers
Radio Range Station
Wildwood Station Storage Tanks
Kenai Airport
Cannery
Trailer Court
Gravel Pit
Oil Well
BEAVER
KENAI RIVER
No Name "A" Cr.
No Name "B" Cr.
No Name "C" Cr.
No Name "D" Cr.
No Name "E" Cr.
R12W
R11W
T6N
T5N

100 Year Flood

500 Year Flood

BEA 5 — Cross Section Location

Stream Channel

Limits of flooding may vary from actual locations on the ground

500 0 500
SCALE IN FEET

Walker Photography 8/79

SHEET 1 OF 7

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BEAVER CREEK

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FLOOD PLAIN MANAGEMENT STUDY

NO NAME "A" CREEK

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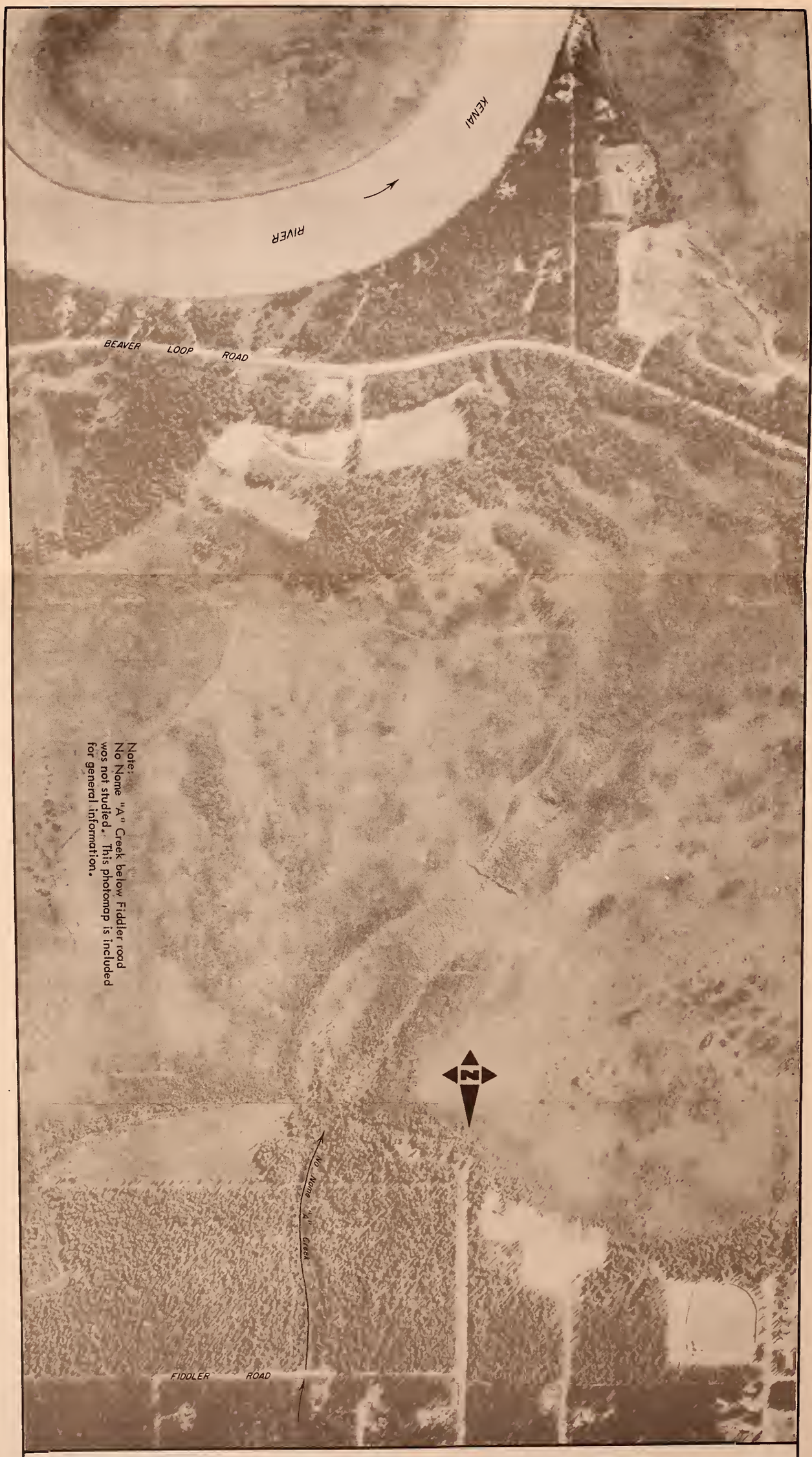

100 Yeor Flood

500 Yeor Flood

BEA 5 — Cross Section Location

Streom Channel

Limits of flooding may vary from actual locations on the ground

500 0 500
SCALE IN FEET

Walker Photography 8/79

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FLOOD PLAIN MANAGEMENT STUDY

NO NAME "A" CREEK

USDA SCS PORTLAND OR 1982

100 Yeor Flood

500 Yeor Flood

BEA 5 — Cross Section Locotion

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SCALE IN FEET

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FLOOD PLAIN MANAGEMENT STUDY

NO NAME "B" AND NO NAME "C" CREEK

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100 Year Flood

500 Year Flood

BEA 5 Cross Section Location

Stream Channel

Limits of flooding may vary from actuol locations on the ground

500 0 500
SCALE IN FEET

Walker Photography 8/79

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FLOOD PLAIN MANAGEMENT STUDY

NO NAME "E" CREEK

USDA SCS PORTLAND OR 1982

100 Year Flood

500 Year Flood

BEA 5 — Cross Section Location

Stream Channel

Limits of flooding may vary from actual locations on the ground

500 0 500

SCALE IN FEET

Walker Photography 8/79

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FLOOD PLAIN MANAGEMENT STUDY

NO NAME "E" CREEK

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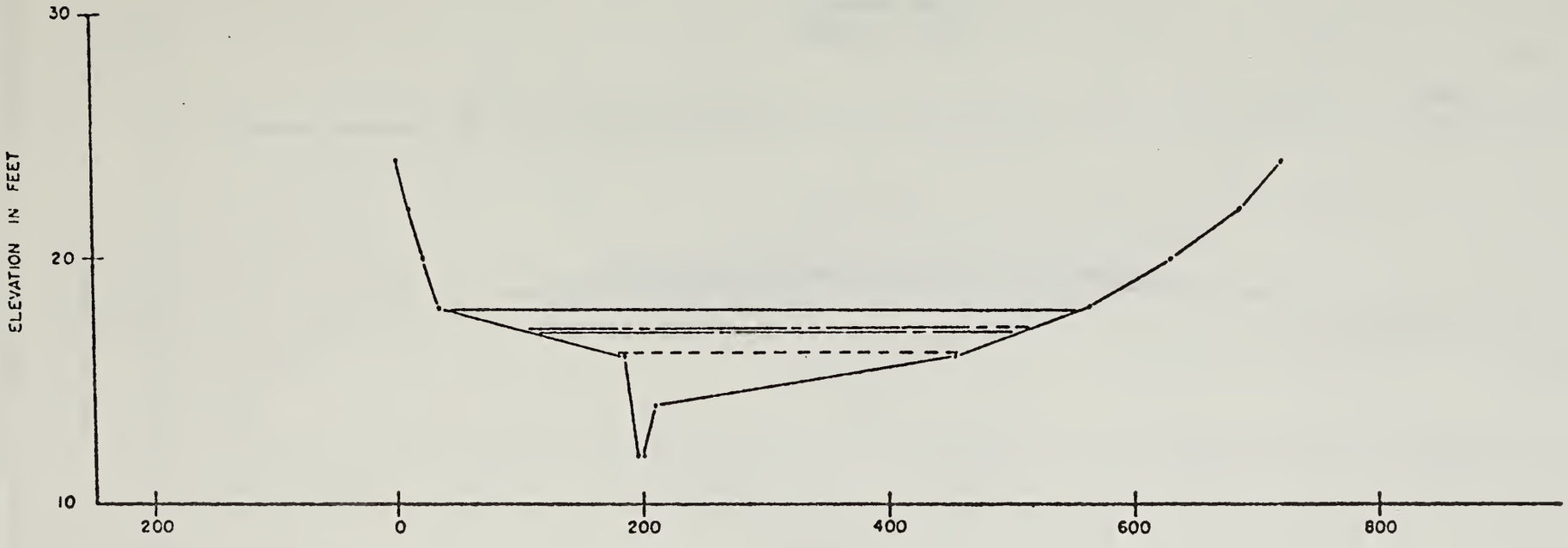
TYPICAL VALLEY SECTION



LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD

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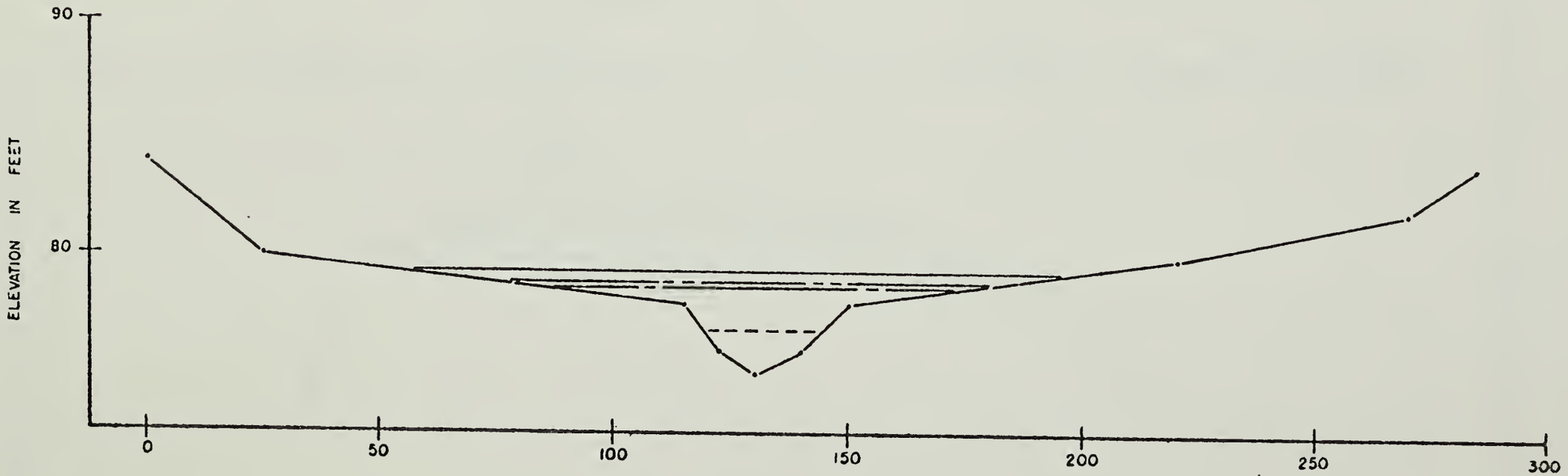
TYPICAL VALLEY SECTION



DISTANCE IN FEET
SECTION NNA7
NO NAME "A" CREEK

LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD

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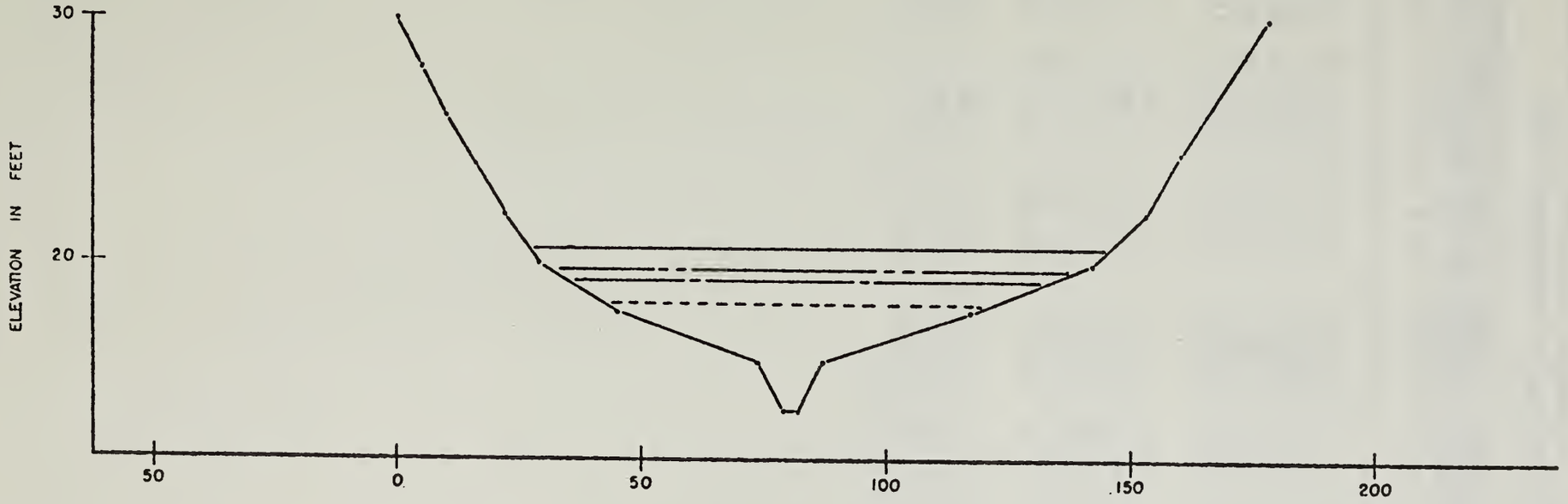
TYPICAL VALLEY SECTION



DISTANCE IN FEET
SECTION NNE7
NO NAME "E" CREEK

LEGEND

500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD

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KENAI FLOOD HAZARD STUDY
KENAI BOROUGH , ALASKA

Table 1. Frequency-Discharge-Elevation Data for Beaver Creek
Drainage Area = 51 square miles

Valley Section	Bottom Elevation	10-Year Flood		50-Year Flood		100-Year Flood		500-Year Flood	
		Disch. (cfs)	Elev. msl	Disch. (cfs)	Elev. msl	Disch. (cfs)	Elev. msl	Disch. (cfs)	Elev. msl
BEA1	3.0	383	13.5	826	13.5	1100	13.5	2040	14.8
BEA2	3.0	383	13.5	826	13.7	1100	13.9	2040	15.3
BEA3	3.0	383	13.5	826	13.8	1100	14.1	2040	15.5
BEA4	6.0	383	13.5	826	14.5	1100	14.3	2040	15.8
BEA5	8.0	383	14.8	826	15.5	1100	15.7	2040	16.8
BEA6	12.0	383	16.2	826	17.0	1100	17.2	2040	17.9
BEA7	14.0	383	19.4	826	21.3	1100	12.6	2040	22.8
BEA8	20.0	383	25.4	826	26.1	1100	26.3	2040	26.7
BEA9	27.0	383	29.7	826	30.2	1100	30.4	2040	30.9
BEAHY	27.0	383	33.7	826	36.9	1100	39.0	2040	42.4
BEA10	27.0	383	33.7	826	36.9	1100	39.0	2040	42.4
BEA11	29.0	383	34.4	826	37.0	1100	39.0	2040	42.4
BEA12	33.0	383	37.4	826	38.6	1100	39.4	2040	42.5

Table 2. Frequency-Discharge-Elevation Data for No Name "A" Creek
Drainage Area = 6 square miles

Valley Section	Bottom Elevation	10-Year Flood Disch. (cfs)	10-Year Flood Elev. msl	50-Year Flood Disch. (cfs)	50-Year Flood Elev. msl	100-Year Flood Disch. (cfs)	100-Year Flood Elev. msl	500-Year Flood Disch. (cfs)	500-Year Flood Elev. msl
NNA1	62.0	45	63.9	97	64.6	130	64.9	240	65.6
FIDLR	65.0	45	69.6	97	69.7	130	69.8	240	69.9
NNA2	64.0	45	69.6	97	69.7	130	69.8	240	69.9
NNA3	64.4	45	69.6	97	69.7	130	69.8	240	69.6
NNA4	67.3	45	69.6	97	69.8	130	69.9	240	70.2
NNA5	70.0	45	71.4	97	71.8	130	72.0	240	72.4
NNA6	71.0	45	73.2	97	73.9	130	74.1	240	74.8
PRMRS	73.0	45	76.0	97	78.6	130	78.7	240	78.9
NNA7	75.0	45	76.8	97	78.7	130	78.9	240	79.3
NNA8	75.0	45	76.9	97	78.8	130	79.0	240	79.4
NNA9	76.0	45	77.7	97	79.0	130	79.2	240	79.7
NNAHY	76.8	45	78.7	97	82.0	130	83.9	240	88.0
NNA10	78.0	45	79.3	97	82.0	130	83.9	240	88.0
NNA11	86.2	45	87.2	97	87.7	130	87.9	240	88.0

Table 3. Frequency-Discharge-Elevation Data for No Name "E" Creek

Valley Section	Bottom Elevation	10-Year Flood		50-Year Flood		100-Year Flood		500-Year Flood	
		Disch. (cfs)	Elev. msl	Disch. (cfs)	Elev. msl	Disch. (cfs)	Elev. msl	Disch. (cfs)	Elev. msl
NNE1		100	13.5	215	13.5	290	13.6	530	14.8
NNE2		100	13.5	215	13.5	290	13.7	530	14.9
NNE3		100	13.5	215	13.5	290	13.7	530	14.9
NNE4		100	13.5	215	13.5	290	13.7	530	14.9
SPRUC		100	17.3	215	17.5	290	17.6	530	17.7
NNE5		100	17.3	215	17.5	290	17.6	530	17.7
NNE6		100	17.3	215	17.5	290	17.6	530	17.7
NNE7		100	18.4	215	19.3	290	19.7	530	20.6
NNE8		100	24.7	215	25.4	290	25.7	530	26.4
NNEHY		100	31.8	215	47.7	290	60.3	530	61.0
NNE9		100	31.8	215	47.7	290	60.3	530	61.0
NNE10		100	34.7	215	47.7	290	60.3	530	61.0
NNE11		100	42.3	215	47.8	290	60.3	530	61.0
FORTH		100	48.9	215	64.4	290	67.3	530	68.0
NNE12		100	48.9	215	64.6	290	67.3	530	68.0
NNE13		100	56.6	215	64.4	290	67.3	530	68.0
NNE14		100	66.1	215	67.1	290	68.3	530	69.2
NNE15		100	74.6	215	75.3	290	75.7	530	76.5
NNE16		100	84.2	215	84.6	290	84.7	530	85.2

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